Evolution of Water Plants.

Water Plants: A Study of Aquatic Angiosperms. By Dr. Agnes Arber. Pp. xvi+436. (Cambridge: At the University Press, 1920.) Price 31*s.* 6*d.* net.

WE have here a comprehensive work embodying the results of a ten years' study of water plants, and dealing in a very practical fashion with the mass of literature that has grown up around the subject. As a book of authority on aquatic plants, it will be ranked with Schenck's work of a generation ago, and it would not receive its due if we did not add that it worthily holds the place. But we must not forget that other industrious investigators have in the meantime filled the gap. Prominent among them are Gluck, Goebel, Henslow, Pond, Sargant, Sauvageau, Willis, and many others. Since Schenck's time, however, new points of view have arisen, and new methods have been in use by numerous inquirers of both sexes, all keen in their desire to take a part in the new era of research.

Yet we find ourselves in an age of unrest and uncertainty in the botanical world. There is a note of discord in the rivalry of the two schools of thought that are divided between the respective claims of the present and the past, or, rather, of the last and first stages of the evolution of the higher plants, to occupy the attention of the investigator. Dr. Agnes Arber speaks of "the deep obscurity involving all evolutionary thought" in our own day, and demurs to the objection that when we cannot even be sure as to the origins of the numerous varieties springing up under our eyes it is not a time for discussing the origins of Dicotyledons or Monocotyledons. In this she is impugning the policy of restricting our efforts to the study of the last stage in the unfolding of the story of plant life. So we get the keynote to her book, the first six-sevenths of which are regarded by her as "a clearing of the ground for the more theoretic considerations concerning the evolutionary history of water plants." But inquiries into their origin must necessarily raise great issues affecting also their relatives on the land; and thus we find in our hands a book that in its general bearings will give birth to much serious thought.

Yet, apart from theory, we have here a very extensive record of observation, experiment, and research on aquatic plants and their ways. The practical side, as we have seen, occupies by far the greater part of the work, and there is a wealth of illustration, mostly original. Quite a third of the space is devoted to the life-histories of the various groups of aquatic flowering plants, and these are followed by discussions on heterophylly, the morphology and anatomy of stems and leaves, the relation of the flowers to their environment, the wintering of water plants, the physical factors in their conditions of existence, and several other matters.

Taking our cue from the author, we will pass on to notice the more speculative portion of her book. There is first the question which might be placed among the "posers" little children are supposed to put. A primitive question about a primitive issue is concerned with the priority of the land- and the water-plant. As usually happens, the problem needs a good deal of straightening out before a reply can be made. Whilst it is generally recognised that the primeval forms were lowly aquatic plants, and that it is only in the higher plants that the terrestrial habit has become firmly established, we are far from being in a position to connect the one with the other.

Botanists are agreed that the aquatic Angiosperms are derived from terrestrial ancestors, but a cleavage in opinion began when they differentiated between Monocotyledons and Dicotyledons. Nature seemed to differentiate between them, and, being impressed by the preponderance of aquatic families among the Monocotyledons, botanists accredited the class with special aquatic proclivities. After considering the matter more closely, the author forms the opinion that these tendencies are hard to maintain.

Continuing to treat aquatic Angiosperms in the mass, and heeding only the systematic distribution of aquatics, the author lays down the principle that when a single genus or a species in an otherwise terrestrial family has taken to aquatic life, the habit may be a recent one; but when a whole family holding several genera is aquatic, we are dealing with a very ancient group of water plants where "the differentiation of the genera has occurred since the adoption of the aquatic habit." There are, in fact, "aquatics, new and old"; and they tend to choose their places in the systematic scale according to their age, the more ancient among the more primitive of the Angiosperms, and the more recent among those more advanced.

To the query as to which are the most primitive of the Angiosperms, the answer is: The families that are held within the Ranalean plexus. Those numerous families that go largely to form the Incompletæ of Bentham and Hooker, and which Engler places at the beginning of the Archichlamydeæ in the scale of development, are regarded as the more advanced and reduced forms

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of that series. Dr. Newell Arber, who supplied the original impulse for this work, laid the foundation for the author's position in this respect, and Miss Sargant's derivation of the Monocotyledons from the primitive Ranalean plexus is here accepted.

An explanation of the great structural reductions involved in the transition from terrestrial to aquatic life, and in the transference by hypothesis of so many families from the beginning to the end of the series of the Archichlamydeæ, became a necessity; so the author proposed her "Law of Loss," which has proved to be related closely to Dollo's "Law of Irreversibility" for animals. This rests on the principle that what is lost in the course of plant evolution can never be regained, and, if required again, "must be constructed afresh in some different mode." From this point of view the leaf-blades of several aquatic plants would be regarded as expansions of the petioles, and much light would be thrown on the many difficult questions involved in the interpretation of the flowers.

The author's position regarding natural selection is discussed, so far as it is determined by aquatic plants. The principle is almost protean in its appearances. When we think we have disposed of it in one shape, it arises in another. If, like Dr. Willis, we exclude it in the case of the genera and species of the Podostemaceæ, it turns up again as the principal factor in the adaptation of the group for life in rapid waters. Dr. Agnes Arber shares with many others her difficulties in accepting whole-heartedly the principle May it not be possible to assume that these difficulties would disappear if we broadened the basis of the theory? Whilst supporting Darwin through so many years, Hooker was holding a view of divergence, under the name of "centrifugal variation" (really a conception of differentiation), that was directly opposed to important points of the theory. Yet he considered that the greatest hope of the investigator lay in the *general* lines marked out by Darwin.

However that may be, we are reminded by the author of this book of an evolutionary idea, both old and new, that is capable of great development. . The principle that what organisms gain in specialisation they lose in plasticity presents us with quite another way of viewing evolution—a view in which progression offers itself as a succession of lost opportunities. Progress in one direction involves the closing of the gates in "countless other directions," the possibilities of choice ever narrowing as we go up the scale. It is suggested that this would be impossible but for the inheritance of acquired characters, bound up, probably, with the inheritance of unconscious memory. At all events, it presupposes a primeval era of plasticity in which heredity had but little power. The line of thought is similar to that followed by Beccari in his theory of plasmation. Here a long vista opens up, and at its distant end lie the problems connected with the origin of the great groups of the plant world.

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The Behaviour of Beetles.

The Glow-worm and other Beetles. By J. Henri Fabre. Translated by Alexander Teixeira de Mattos. Pp. viii+488. (London: Hodder and Stoughton, Ltd., 1919.) Price 8*s*. 6*d*. net.

THIS is the second volume on beetles in the complete English edition of Henri Fabre's entomological works. The first essay, "The Glow-worm," which gives its name to the book, did not form part of the "Souvenirs Entomologiques," but was written for translation into English towards the close of the veteran naturalist's life. Several chapters, like this first one, have already seen the light in English, but most of the book is fresh, and it is very convenient to have the studies on beetles brought together. Eventually there will be four volumes on beetles. The experienced translator, Mr. Alexander Teixeira de Mattos, has done his work with great skill.

These are wonderful stories. The glow-worm tweaks a snail with its sharp mandibles, and administers an anæsthetic; a number of other glow-worms hasten to the repast and fall to; the flesh is converted by exuded ferment into a sort of gruel, and the fluid is sucked up by the hollow jaws. We suspect that there is some inaccuracy in Fabre's account; it seems clear, for instance, that the fluid food enters the gullet by the mouth, and not *via* the mandibles. In any case, Fabre's observations must be compared with those of Bugnion and Miss Kathleen Haddon. In regard to the luminescence Fabre was cautious:—

> "From start to finish, the glow-worm's life is one great orgy of light. The eggs are luminous; the grubs likewise. The full-grown females are magnificent light-houses, the adult males retain the glimmer which the grubs already possessed. We can understand the object of the feminine beacon; but of what use is all the rest of the pyrotechnic display? To my great regret, I cannot tell. It is and will be, for many a day to come, perhaps for all time, the secret of animal physics, which is deeper than the physics of the books."

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